THE CREATIVE LIFE OF S. V. IL'YUSHIN

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16. Abstract

The professional career of aircraft designer S. V. Il'yushin is outlined in connection with his 80th birthday. In this context a brief history is given of the design office headed by Il'yushin and a brief description is given of some of the planes developed by this office for military and civilian purposes.

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G. V. Novozhilov

Eighty years have passed since the birth of Academician Sergey Vladirimovich /14* Il'yushin, general aircraft designer, twice Hero of Socialist Labor, and recipient of the Lenin and State Prizes; forty years have passed since he established a design office. The creative career of this renowned creator of airplanes is discussed by general designer, Hero of Socialist Labor, Lenin Prize recipient Genrich Vasil'yevich Novozhilov.

I met Sergey Vladirimovich Il'yushin for the first time at the Moscow Aviation Institute in 1947. An aircraft designer of world renown and the creator of the legendary Ils, he was at the time engaged in intensive teaching work, directing the Department of Design at the N. Ye. Zhukovskiy Air Force Academy. At the Moscow Aviation Institute he was the chairman of the State Examination Commission. In his talks with students Sergey Vladirimovich would talk enthusiastically about the process of bringing new aircraft into the world and would stimulate creative thinking. Especially clear in my memory is his account of how he created the Il-2.

"Around the year 1936," said S. V. Il'yushin, "we designers were called to the Central Committee of the Party. The task was assigned of designing an airplane for direct combat support of troops, or in other words, a "flying tank" of high firepower and of a high degree of invulnerability.

"The creation of an armored attack plane proved to be a highly complex problem. At times I was seized by doubts as to whether the enormous risk I was taking was justified.

"The chief problem lay in arriving at a design making it possible to resolve the contradiction between the great weight of the armor and weapons, on the one hand, and achieving the required performance, on the other. After thinking the matter over for a long period of time I became convinced that what was needed was not to sheathe the frame of the aircraft with armor but to make the frame

*Numbers in the margin indicate pagination in the foreign text.

itself out of armor. I was well aware, of course, of the difficulties we would encounter: up to that time no one had stamped armor and my predecessors had no choice but to use flat shapes. But there was no alternative, and I took the risk. The technological difficulties involved in stamping an armored body were successfully overcome. Subsequent tests of the aircraft demonstrated that we had arrived at the optimum solution. The plane had a speed which was good for an attack plane, up to 246 km per hour, and good stability and maneuverability.

"The weapons consisted of 4 guns, a heavy machine gun, 4 rockets, and up to 600 kg of bombs. The combat efficiency of the Il-2 on the fronts of the Patriotic War are well-known. This is also attested by the nickname which the fascist invaders gave to the plane: the 'Black Death'.

"Another plane of ours, the Il-4 broad-range bomber, was created 5 years before the war began and confirmed its excellent qualities in combat operations. It was precisely with this plane that Soviet airmen carried out the first bombing raids against Berlin, Dresden, Frankfurt-am-Main and other cities of the Third Reich." S. V. Il'yushin ended his account with these words.

A group of graduate students, including myself, came to S. V. Il'yushin's design office at the beginning of 1948. There were about 300 specialists working in the office at the time.

In his speech of welcome to us Sergey Vladirimovich said:

"Here in our group we have just one motto: Work, work, and more work, but productive work, with no wasted effort. You must not get bigheaded when things turn out well. Make use of past developments of good quality which have proved themselves in service; change a design only when you are absolutely certain that you can do better."

Brief mention should be made of Sergey Vladirimovich's style of work. Every morning he would arrive at the design office with a plan of work already prepared. And during the day he would look into the office from time to time to see what had been accomplished and what still remained to be done.

S. V. Il'yushin generally began his tour in the mockup shop. He inspected the wind-tunnelsmodels very carefully. If something was not as it should have been, he immediately showed the model makers and designers on the spot what

corrections had to be made. If he saw that work was going too slowly and was being done in haphazard fashion, he made severe and sometimes biting comments on the situation.

From the mockup shop he went to the assembly department. He carefully inspected the aircraft being built. He devoted an especially great amount of time to study of the structural units which were worrying him. It must be said that Sergey Vladirimovich had a remarkably developed sense of what was correct in design. We often had occasion to observe how he found weak or obviously overloaded points in a design merely by visual inspection, by means of some sort of subconscious flair which he alone possessed. And S. V. Il'yushin's viewpoint was unerringly confirmed after painstaking calculations had been performed for purposes of verification.

He would make his decisions on the spot: he would call the designers into the shop and listen to their opinion attentively, but after all the discussions and debates the General Designer had the last word. Then everything was set in motion: drawings were sent out for revision, the production shops quickly and efficiently produced the parts, and the latter were immediately sent for assembly.

I should like to emphasize that the word of S. V. Il'yushin was an inviolable law both in the design office and in production. He never repeated his instructions, and indeed there was never any need for this.

During the first half of the day, the time of highest working efficiency, Sergey Vladirimovich concerned himself with nothing but designing. He deferred all organizational matters, conferences with any authorities whatever, trips, and so forth to the end of the day. This procedure was compulsory for everyone, from the head of the department down to the rank-and-file designer. During this time the telephones were cut off, visits by teams of specialists for liasion purposes were forbidden, and no trips on official business or reception of /15
visitors were permitted. In short, absolutely everything was done to create a truly creative atmosphere. The productivity of labor was very high: the design office developed a new airplane almost every year.

What was Sergey Vladirimovich's approach to designing? Il'yushin was always an innovator; all his work was noted for daring design solutions. The Il-2

"flying tank", the TsKB-32 fighter plane with a surface radiator (double water--cooled skin), the Il-22, the first domestically produced jet bomber with the engines suspended on pylons (this was done long before a similar design made its appearance in the United States) and many other planes are characterized by fundamental innovations. But in creating original aircraft designs S. V. Il'yushin never rejected the very best developments which had been achieved earlier. More than once he told us young specialists that "the creative path of a designer is that of continuous evolutionary improvement in a design or assembly. Only after definite advances have been accumulated in previous studies is there a leap in quality and something entirely new makes its appearance."

There is another characteristic of S. V. Il'yushin which I would like to relate: the extraordinary accuracy of his foresight. He foresaw the course of development of aviation many years in advance. He often began the development on his own initiative of airplanes which were built and put into large-scale production when they were especially badly needed by the country. Such was the case with the Il-2, Il-4, Il-14, Il-28, Il-18, Il-26... These were material manifestations of the national treasury of ideas embodied in Sergey Vladimirovich, a Party member since 1918, Deputy to the Supreme Soviet of the USSR, public figure. Not only did S. V. Il'yushin make timely presentation of aircraft possessing outstanding flight performance characteristics to the country, but also assured that these aircraft would be of simple and practicable design.

One of the basic specializations in the work of our design office is the development of aircraft for civil aviation. The experience acquired in developing passenger airplanes of the "Il" make proves convincingly that it was precisely a profound understanding of the purpose for which a new airplane is created that enabled S. V. Il'yushin to find optimum structural designs assuring a long service life for his aircraft.

The year 1943 came. The bitterest imaginable battles were being fought on the battlegrounds of the Great Patriotic War. In this situation placing such a great strain on the country the Communist Party and the Soviet government deemed it necessary to start work even at that time on accelerated development of postwar transport. S. V. Il'yushin began to design a 27 to 32-seat passenger plane with

a range of up to 2,000 kilometers. In 1946 this plane, which was called the Il-12, was commissioned on the Aeroflot line. It had very good flight performance characteristics, ones better than the famous American DC-3 and the Soviet Li-2. The Il-12 was to be used not only to transport passengers but also to carry widely varying loads weighing up to three tons; this was a major accomplishment at the time.

The Il-14 plane developed in 1953 represented an advance over the Il-12. A higher degree of dependability, especially in the event of engine failure on take-off, and greater passenger comfort were provided in it. In addition, the latest piloting and navigational equipment and radio equipment of the time were installed in it. The Il-14 was produced in modifications literally for all contingencies. In all there were as many as fifteen alternate lay-outs and special equipment corresponding to each modification. As regards its flying qualities it is a dependable aircraft simple to control. And today polar explorers, geologists, and fishermen cannot imagine not having this airplane for their work.

The next airplane, the Il-18, belongs to the age of jet aviation. S. V. Il'yushin assigned the designers of the office the task of creating an aircraft such as this which would be economical and easy to operate. It was necessary to lower the cost of a ticket for this airplane to a level equal to or near that of a trip in a railroad pullman carriage. The Il-18 was designed and built in record time.

And mention should be made here of S. V. Il'yushin's special approach to the testing and perfection of each new airplane. Attention was concentrated chiefly on flight safety and dependability of the airframe, systems, and equipment of the airplane. Had everything been done to assure that it would be possible to carry two to three times more passengers than our earlier planes? The designers made a thorough analysis of the key structural units and studied the results of all possible tests and reference checks. All comments and deficiencies established during operational tests were subjected to the most thoroughgoing analysis possible, and measures were immediately taken to eliminate these deficiencies.

"No, we still have not done everything," S. V. Il'yushin would say sharply whenever anyone would try to have him hurry up a decision to begin passenger flights. But the work on improvement of a plane in production did not end after it had been placed in service on an air line.

"You must devote thought and care above all to planes which are already flying and carrying passengers," S. V. Il'yushin often told designers.

Despite the fact that he was extremely busy, he always found time to talk to ordinary pilots. He listened to all their comments carefully and never left them without giving them an answer. And this principle, which has repeatedly proved its fruitfulness in the experience of our design office, has been adopted as the basis of our staff's work. And we are firmly convinced today that only close contact with aviation enterprises and constant study and generalization of their experience will aid us in successful completion of the highly important tasks assigned by the Twenty-Fourth Congress of the Party and the December Plenum of the Central Committee of the Communist Party of the Soviet Union to all personnel in air transport and the aviation industry.

A large number of Il-18 airplanes were produced on the basis of orders from the Ministry of Civil Aviation and 17 foreign airline companies, while its "rivals," the "Vanguard" manufactured by Vickers (England) and the "Electra" manufactured by Lockheed (USA), have never been used on a large scale. S. V. Il'yushin and a group of designers were awarded the Lenin prize for developing the Il-18.

Time passed, and higher requirements were set for increase in the range of flight of aircraft. Our staff had the mission of finding ways and means of solving this problem. A second-generation jet liner, the Il-62, was developed. S. V. Il'yushin proposed for its configuration a four-engine power plant mounted on the tail portion of the fuselage. This made it possible to effect considerable reduction in engine noise in the engine compartment, and also to develop a "pure" wing possessing good aerodynamic properties and to devise an effective lift augmentation device. Much labor and ingenuity was required of S. V. Il'yushin in developing a fundamentally new configuration of a chassis with a retracting tail support. This configuration substantially reduced the weight gain in air-

frame design inevitable when the engines are positioned in the tail portion of the fuselage. In January 1963 the Il-62 made its first flight.

The intercontinental Il-2 was subsequently modified in our design office. We used the new (D-30KU) turbofan engines (designed by P. A. Solov'yev) with a takeoff thrust of 11,000 kg, relatively low fuel consumption, and reversing devices. At the same time that the engines were replaced, the fuel supply was increased to 5,000 liters by creating a sectional tank in the rudder, and the aerodynamic shapes of the engine nacelles and the stabilizer and rudder fairings were improved. Improvements were made in the flight and navigational instruments and radio equipment. As a result, the Il-62M can carry a much heavier load at a higher speed over routes of the same length than can the Il-62. But we by no means regard the work on the family of Il-62 airplanes as having been completed. Increase in dependability, improvement in the technological effectiveness of operation and repair, increase in airplane safe life, introduction of automated equipment, reduction of the minimum meteorological data required, and other important matters are being carefully examined by our design office.

Aviation is being more widely used each year in the national economy. Hence the urgent need has arisen for the development of an economical high-speed transport plane. At the Paris aviation exposition in 1971 the close attention of visitors was attracted by a new jet transport plane, the Il-76, which was developed in our design office. It is designed to carry all types of commercial cargo, agricultural machinery, and industrial equipment. Owing to its good takeoff and landing characteristics, ability to clear difficult terrain, and mechanization of loading and unloading operations, the plane can be successfully used in remote areas of the Soviet Union and abroad which are difficult of access.

The new Il-86 passenger airbus on which we are now working is somewhat unusual. It will carry 300-350 persons. It represents the third generation of jet passenger liners. When this "airbus" is placed in service on an air line with heavy passenger traffic it will permit reduction in the frequency of flights on them, and this is a highly important matter. Even now difficult situations often arise at many airports in the country, such as those at Leningrad, Kiev, Khabarovsk, Tashkent, and Sochi, when the holding time in the air is greatly increased because of the large number of arriving aircraft.

An analysis made by the Ministry of Civil Aviation has shown that 35.6% of all passenger traffic is to a flight distance of 1,000 to 1,500 kilometers. The results of this study have been adopted as a basis in setting the requirements for the new airplane. Its range of flight will be 2,350 km with the maximum payload. It will also be able to develop a cruising speed of up to 950 km per hour. The flight altitude will range from 9,000 to 11,000 meters, and the landing approach speed will be 240 to 250 kilometers per hour. The Il-86 will carry 300 passengers nonstop to a distance of 3,500 kilometers. A modification of the Il-86 having a much greater range is also planned. Final design of the structural elements of the new Il-86 airplane has already begun. The best specialists of the State Civil Aviation Scientific Research Institute and "Aeroproyekt" will participate directly in the design process in the performance of many operations. This mode of operation will make it possible to reflect to the fullest the requirements set by operating personnel for the airplane. In addition, the joint work on the stands will reduce the time required for certification of the plane to obtain permission for its operation on international air lines.

Thus in the four decades of its existence the design office directed by Academician S. V. Il'yushin has brought into existence airplanes of widely varying types and modifications which have given good accounts of themselves both in the threatening skies of war and in scheduled flights in peacetime. Planes of the "Il" make are widely known in the USSR and abroad.

The staff of the design office wishes to extend its most cordial congratulations to outstanding aircraft designer Academician Sergey Vladimirovich Il'yushin on his anniversary.

Today, on the anniversary of the founder of our design office, we want to state that new planes of the "Il" make will faithfully serve our country.

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